SB761
U7R6
85-10

FOREST PEST MANAGEMENT

LIBRARY COPY
ROCKY MT. FOREST & RANGE
EXPERIMENT STATION

United States
Department of
Agriculture

Forest Service

Forest Pest Management
Denver, Colorado

3430 BIOLOGICAL EVALUATION

R2-85- 10

WESTERN SPRUCE BUDWORM of the CUCHARA VALLEY SKI AREA and PLANNED EXPANSION AREA

PREPARED BY: C. Kendall Lister and E. Michael Sharon

C. K. LISTER
Entomologist

E. M. SHARON
Pathologist

RECOMMENDED BY: Robert D. Averill

ROBERT D. AVERILL
Group Leader, Entomology

David W. Johnson

DAVID JOHNSON
Group Leader, Pathology

William P. Gee

WILLIAM P. GEE, Acting Director
Timber, Forest Pest, and
Cooperative Forestry Management

Timber, Forest Pest and
Cooperative Forestry Management
Rocky Mountain Region
USDA Forest Service
11177 W. 8th Avenue
Lakewood, Colorado 80225

INTRODUCTION

In response to a request from the Forest Supervisor, Pike and San Isabel National Forests, a biological evaluation was conducted at the Cuchara Valley Ski Area and expansion area. The biological evaluation was conducted during the fall of 1985 by E. Michael Sharon, Pathologist and Ken Lister, Entomologist.

Some conifer trees had died during the summer of 1985. When the tree mortality was noticed by the management personnel of Cuchara Valley and San Carlos Ranger District they became concerned, requesting some evaluation assistance to investigate the cause and recommend action.

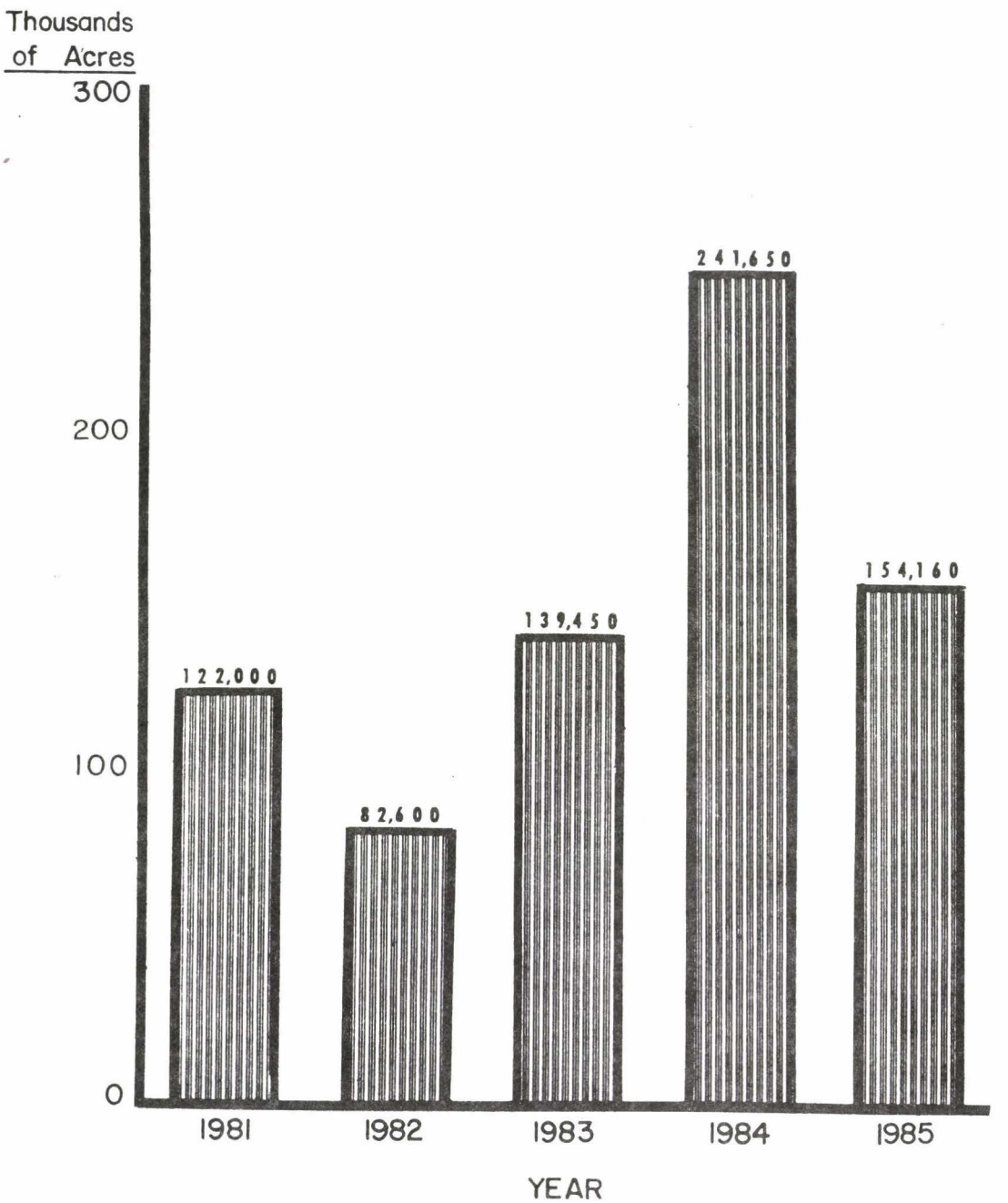
Two conditions present at Cuchara Valley suspect of contributing to tree mortality are: (1) foliage injury caused by extreme cold weather occurring in December 1983, and (2) a persistent infestation of western spruce budworm(WSB).

A large and very cold air mass developed over southeastern Colorado, the Texas panhandle, and northeastern New Mexico in December 1983; this phenomenon has been documented in the following reports: R-3 Memorandum 3430, May 18, 1984, R-2 Service Trip Appraisal Reports, 84-3, May 7, 1984 and 84-15, October 15, 1984. During the spring of 1984 many people reported unusual vegetation coloration and appearance such as light to reddish coloration of conifer foliage and branch dieback or stunted leaves on hardwoods. Subsequently pathologists and entomologists were involved in identifying the cause. After investigation it was concluded the extensive damage was caused by the unusually cold weather which occurred during late December of 1983. Severity of the freeze damage was variable. However, within this large area freeze damage has occurred to virtually all perennial species. Freeze damage to conifers has been observed as far north as Canon City, Colorado, and south to Carrizozo, New Mexico, occurring along the east slope mountains forming the western edge of the Great Plains.

The WSB infestation at Cuchara Valley is part of a major outbreak in Colorado. In the early 1970's the outbreak developed throughout the Colorado Front Range, occurring in host type from the Continential Divide east to the Great Plains and from Wyoming to New Mexico. The acreage of WSB defoliation damage expanded annually until 1983 when it peaked at 1.75 million acres for the Front Range, and simultaneously the Region-wide acres of defoliation was 2.7 million. Since then, it has decreased. The 1985 estimate is 1.6 million acres Region-wide.

For the WSB infestation on the San Isabel National Forest, the peak was in 1984 at 241,650 acres, decreasing to 154,160 acres in 1985, as illustrated in Figure 1. Review of Forest Pest Management records indicates the WSB infestation for the Cuchara Valley area originated in 1976.

Figure 1 -- Acres of Western Spruce Budworm occurring on the Pike and San Isabel National Forests for the years 1981 through 1985.



TECHNICAL INFORMATION

Insect: Western spruce budworm, *Choristoneura occidentalis* Freeman

Hosts: Douglas-fir, *Pseudotsuga menziesii* (Mirb.) Franco
White fir, *Abies concolor* (Gord. & Glend.) Lindl.
Subalpine fir, *Abies lasiocarpa* (Hook.) Nutt.
Blue spruce, *Picea pungens* Engelm.
Engelmann spruce, *Picea engelmannii* Parry

Life History: The western spruce budworm completes one generation each year.

Stage	Time	Location on Host
Egg	August	On needles
Small larvae	Overwinter	In hibernaculum (silken cocoons) on branches and trunk
Larger larvae	June	On buds, strobile, and foliage
Pupae	July	On foliage
Adults	August	In flight

Evidence of Infestation

1. Presence of partially eaten foliage.
2. Mature larvae feeding on current year's needles.
3. Current year's shoots webbed together by larvae.
4. Defoliation most evident in upper crowns of trees.
5. Trees dying from the top downward after several years of heavy defoliation.

METHODS

For this evaluation, two field trips were made: (1) to obtain branch samples to rate and monitor budworm conditions, and (2) reconnaissance of the area to observe the freeze damage and examine for other significant factors.

WSB Egg Mass Survey

One 27-inch branch was pruned from midcrown of each sample tree. The foliage samples were bagged, labeled, and transported to the laboratory. In the lab, all branches were examined and all budworm egg masses were extracted. A stereoscope was used to separate new from old egg masses, allowing us to predict defoliation for next year.

Egg mass density, classes, and expected defoliations are displayed in Table 1. These classes are from McKnight, et.al.(1970), and were refined by Linnane (1978) based on four years of data.

Current defoliation levels were made from the egg mass sample branches. For each sampling site, the new shoot growth on 25 randomly selected twigs were examined in the laboratory to determine the percent of defoliation. Defoliation estimates are based on the percent of missing needles determined by an ocular examination of each twig.

Table 1. Defoliation Prediction Classes for Western Spruce Budworm Egg Mass Sampling in the Rocky Mountain Region.

Class	Mean Number of New Egg Masses Per Square Meter Foliage	Defoliation Prediction [1]
1	1.6 or less	Undetectable
2	1.7 to 10.0	Light
3	10.1 or more	Moderate to Heavy

[1] Defoliation expected on new growth of Douglas-fir or white fir only.

Undetectable	0 - 10%
Light	10 - 35%
Moderate	36 - 65%
Heavy	65 - 100%

RESULTS AND DISCUSSION

The results of the western spruce budworm foliage sampling are displayed in Table 2. These data indicate a decrease in the budworm population and defoliation damage in 1986. In 1985, defoliation was heavy at the ski area and moderate in the expansion area. The predicted defoliation for 1986 is two classes lower, light in the ski area and undetectable in the expansion area.

Table 2. Results of the Western Spruce Budworm Egg Mass and Defoliation Survey of Cuchara Valley Ski Area.

Sample Area	Number of Branch Samples	1985 Defoliation Estimate	Mean No. of Egg Masses per Meter ^{2}	1986 Predicted Class Defoliation
Existing Ski Slopes	42	67.7% $\pm$ 4.9	6.31 $\pm$ 1.55	Class 2, Light
Expansion Ski Slopes	30	46.7% $\pm$ 5.1	.27 $\pm$ .27	Class 1 Undetectable

During the reconnaissance of the ski area it became obvious there were two major damage situations; the western spruce budworm infestation and extensive tree damage caused initially by cold weather in 1983. The WSB defoliation was found within an elevational zone of 9,800 feet to 10,200 feet. The freeze damage occurred from the area base upslope to 9,800 feet. The base elevation is 9,200 feet.

Logistically, these two causes of damage were operating independently during 1985. Initially, confusion existed because conifers with top and branch dieback due to chronic WSB defoliation occurred within both the freeze damaged area and the current (1985) WSB infestation zone. Apparently, WSB could not survive within the freeze damaged area.

In the freeze damage area (lower slopes) all conifer species had been affected, although the severity varied from tree to tree. Occasionally, some conifers seemed to have escaped or were able to tolerate the cold. On the other hand, some conifers died, apparently in 1985. Evidence of tree recovery existed at all observation points. New shoots, although stunted, were observed on a majority of the conifers. Recovery is expected to be slow and additional tree mortality is likely to occur. It seems logical to expect that adequate stocking will survive over most of the area; however, some spots may need treatment to aid regeneration or supplemental planting to meet the management needs.

RECOMMENDATIONS

1. Suppression of WSB is not recommended for 1986, since a decrease in damage is predicted.

2. Develop a realistic Vegetation Management plan for implementation in the Cuchara Valley Ski Area and the expansion area to meet the desired management goals and objectives for the ski area.